Claims

1. Device for dispensing droplets comprising:

- a first channel, known as main channel, comprising at least one branch, for circulation of a first fluid flow,

- a second channel for circulation of fluid, comprising at least one branch, which forms an intersection zone with the first channel and terminates via an ejection orifice,

- measuring means of a physical property of particles or cells in the first channel, and

- means for generating a pressure wave in the second channel.

2. Device according to claim 1 comprising two branches of the main channel, and at least one branch of a secondary channel, which join up in the intersection zone.

3. Device according to claim 2, comprising an input opening of the first fluid flow connected to a first branch of the first channel, and an injection opening of another fluid flow in the second channel.

4. Device according to claim 1 wherein the second channel comprises branches on either side of the main channel.

5. Device according to claim 1 wherein, apart from the ejection orifice of droplets which

provides an outlet for part of the flow, the device comprises another outlet orifice for another part of flow.

6. Device according to claim 1 comprising a platform of a first substrate and a plate of a second substrate covering the platform, in which, or on which, or between which, or at the interface of which, the channel branches are arranged.

7. Device according to claim 6 further comprising at least one layer deposited on the surface of the substrate(s) or at least an intercalary film inserted at the interface of the plate and of the platform, the channel branches being digged or pierced in said layer(s) or in said intercalary film(s).

8. Device according to claim 7 wherein each layer deposited on the substrate surface or each intercalary film inserted at the interface of the platform and of the plate are composed of one or more materials selected from the group of materials comprising etching materials of electronic field, resins, polymers, dielectric materials, insulating compounds of semi-conductor elements, especially photosensitive or electrosensitive resins, polyimide, polystyrene, polyethylene, polyurethane, polyvinyl, poly-dimethylsiloxane, nitrides, oxides and silicon compounds, as well as glass.

9. Device according to claim 7 wherein at least one opening and/or one orifice are pierced through the thickness of the substrate of the platform and/or of the plate.

10. Device according to claim 6 wherein the substrate of the platform and/or of the plate is made of glass.

11. Device according to claim 10 wherein at least one orifice and/or one opening and/or at least one channel branch are pierced or digged in the substrate.

12. Device according to claim 1 wherein the channel branches form capillaries having transversal dimensions of the order of a few tens of nanometres to a few millimetres.

13. Device according to claim 1, comprising means for measuring optical properties of a fluid flow and/or means for measuring the impedance of the medium and/or means for measuring electric parameters of a fluid flow, which preferably are placed near the intersection zone.

14. Device according to claim 1, the measuring means comprising a series of electrodes, which preferably are arranged along at least one channel branch.

15. Device according to claim 14 wherein matching electrodes are arranged on either side of a channel branch.

16. Device according to claim 1 wherein at least three microelectrodes are arranged in a channel branch for measuring differential variation of impedance.

17. Device according to claim 1 further comprising an electrovalve and/or a physical-mechanical actuator for generating a pressure wave and/or a flow.

18. Device according to claim 1, comprising control means for receiving measuring signals originating from means for measuring physical properties, and for sending a control signal to the means for generating a pressure wave.

19. Device according to claim 18 wherein the control means are suitable for controlling the amplitude and/or the triggering instant, and/or the form, and/or the duration of the control signal.

20. Device according to claim 1, further comprising means for supply and/or continuous circulation of fluid in the main channel and/or at least one tank connected to a respective channel branch for containing a liquid, in particular a liquid or a medium comprising a solution or a cellular suspension.

21. Device according to claim 1, further comprising a confinement enclosure.

22. System for depositing at least one sample on a substrate comprising a dispensing device for droplets according to claim 1 associated with means for scanning or relatively shifting of the substrate and the dispensing device so that the ejected droplets can be deposited from place to place on the substrate.

23. Method for dispensing droplets, making use of a first channel and a second channel which forms an intersection zone with the first channel and terminates in an ejection orifice, the process comprising the steps consisting of:

- circulating a first fluid in the first channel;
- measuring a physical property or analysing the contents of the flow of the first fluid; and,
- generating a pressure wave as depending on the results of the preceding step.

24. Method according to claim 23 comprising a step consisting of injecting a second fluid flow in or towards the intersection zone together with the steps of generating a pressure wave, the second flow being different from or identical to the first fluid in composition.

25. Method according to claim 24, comprising steps consisting of:

- supplying an input opening of a branch of the channel with a continuous flow of the first fluid;
- feeding an injection opening communicating with the intersection zone by a flow of the second fluid.

26. Method according to claim 25 wherein dilution or a mixture of the first fluid and of the second fluid is collected at an outlet opening of the channel or at the droplets ejection orifice.

27. Method according to claim 24 wherein the second flow comprises means of reaction or interaction with the first fluid, especially at least a reagent and/or an active ingredient, and/or a marker, and/or a nutrient medium, and/or a chemical product, and/or an antibody, and/or a DNA sequence, and/or an enzyme, and/or a protide, and/or a protein, and/or a biological factor, and/or a stimulant, and/or a growth inhibitor.

28. Method according to claim 23, comprising a step consisting of:

- delivering an electrical command calibrated for injecting the second fluid flow to the intersection zone, the electrical command having an amplitude and/or a triggering instant and/or a form and/or a pulse duration controlled to eject a droplet of controlled or calibrated volume.

29. Method according to claim 23 wherein a concentration, separation, and/or extraction, and/or selection and/or collection of components of the first fluid is gathered at the ejection orifice of droplets or at the outlet opening of the channel.

30. Method according to claim 23 wherein the first fluid comprises a liquid, or a solution, or a suspension or a medium containing biological cells, and/or components and/or cellular products, especially bacteria, and/or cellular lines, and/or globules, and/or cellular nodes, and/or chromosomes, and/or strands of DNA or RNA, and/or nucleotides, and/or ribosomes, and/or enzymes, and/or protides, and/or proteins, and/or parasites, and/or viruses, and/or polymers, and/or biological factors, and/or stimulants, and/or growth inhibitors.

31. Method according to claim 23 wherein the first fluid comprises a liquid or a solution, or a suspension, or a medium containing particles which are preferably solid particles insoluble in liquid, such as dielectric particles or electric particles, or magnetic particles, or pigments, or dyes, or protein crystals, or powders, or polymer structures, or insoluble pharmaceutical substances, or clusters or aggregates of small size formed by agglomeration of colloids.

32. Method according to claim 23, comprising an intercalary step consisting of:

- triggering an ejection control pulse of droplets as a content of interest passes.

33. Method according to claim 23, comprising an intercalary step consisting of:

- undertaking cytometric analysis of the flow of the first fluid to detect biological particles or cells, cellular components or products contained in the flow; and,

- triggering an ejection control pulse of droplets for isolating the biological particles or cells, the cellular components or products which have been detected.

34. Method according to claim 23, the measuring step comprising at least measuring one electric parameter and/or measuring impedance or differential variation of impedance of the contents of the flow of the first fluid circulating in the channel, and/or optical measuring of the contents of the flow of the first fluid circulating in the channel.

35. Method according to claim 23, wherein droplets of low volume are generated, especially of the order of a femtolitre to a microlitre, or of a micrometric diameter, of the order of 0.1 μm to a few millimetres.

36. Method according to claim 23, wherein droplets of fluid are ejected from place to place on a substrate or a support.

37. Method according to claim 23, being used in a confined atmosphere.

38. Method according to claim 23, applied to extraction, selection and/or screening of cellular lines; and/or to detection, and/or identification, and/or counting and/or characterisation of biological particles or cells, components or cellular products, and/or to the deposition of particles or biological cells, or cellular components or products, on preferred sites of implantation and/or growth and/or regeneration and/or grafting, especially cellular lines, or biopolymers, or biological factors, or stimulants or growth inhibitors; and/or to dispensing of microflow of biological or chemical reagent at corresponding places where droplets containing active biological components are dispensed, dispensing of reagents occurring either during dispensing of the active biological components or by differed dispensing of other droplets on sites on which the droplets of active biological components have been deposited previously or will be deposited later.

39. Method for counting particles, using a device according to claim 1, fluid containing particles circulating in the first channel, the particles being counted by measuring means or optical means.

40. Device for dispensing droplets comprising:

- a first channel, known as main channel, comprising two branches, with an input opening for circulation of a first fluid flow,

- a second channel with an injection opening for circulation of a second fluid, comprising branches on either side of the main channel, and which terminates via an ejection orifice for part of the flow and another outlet orifice for another part of flow,

- the branches of the first and second channel joining up in an intersection zone,

- a series of electrodes for measuring a physical property of particles or cells in the first channel, matching electrodes being arranged on either side of a channel branch, and

- means for generating a pressure wave in the second channel.

41. Device according to claim 40, wherein the electrodes are suitable for measuring optical properties of a fluid flow and/or the impedance of the medium and/or electric parameters of a fluid flow, and/or differential variation of impedance.

42. Device according to claim 40 further comprising an electrovalve and/or a physical-mechanical actuator for generating a pressure wave and/or a flow.